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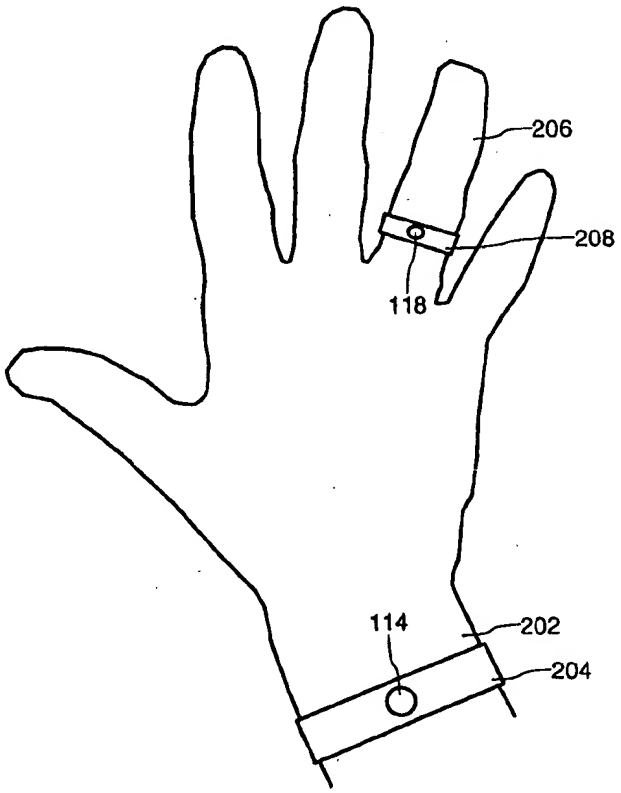
(57) Abstract

A personal communications apparatus comprises a first part, having a microphone (114), and a second part, having a loudspeaker (118). The first part is adapted to be worn on a user's wrist (202) and the second part is adapted to be worn on their finger. In use, the user's hand is held up to the side of their head, thereby placing the microphone (114) adjacent to their mouth and the loudspeaker (118) adjacent to their ear. Communication between first and second parts of the apparatus is by means of signals transmitted via the user's skin. In a non–illustrated embodiment the second part is adapted to be worn on the ear.



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DESCRIPTION

PERSONAL COMMUNICATIONS APPARATUS

Technical Field

The present invention relates to a personal communications apparatus comprising a first part having a microphone and a second part having an loudspeaker. In particular, such an apparatus may be a wireless telephone or two-way radio transceiver.

Background Art

At present, wireless telephones are available either with microphones and loudspeakers built into the main body of the phone, which is then hand-held in a conventional manner, or with headsets which enable the user to operate in a hands-free manner. Progress in miniaturization of electronic components has enabled proposals for wrist-carried wireless telephones, which have the advantage of being more convenient to carry than a separate hand-held telephone. However, such proposals must address the problem of extending the distance between the microphone and loudspeaker to correspond to the actual spacing between a user's mouth and ear.

A range of solutions to this problem has been suggested. Those discussed below all relate to a wrist-carried radio telephone having a case including a transceiver, and a strap for attaching the case to the user's wrist.

US-A-5 659 611 discloses a telephone in which a microphone and an earpiece are mounted in separate caps which, when in use, are placed on two of the user's fingertips. Electrical connections between the transceiver in the wrist-mounted case and the microphone and earpiece are provided by electrical wires. When not in use the electrical connection wires retract into the case and the caps are stored in close proximity to the case.

In the telephone disclosed in US-A-5 467 324 a microphone is included in the case, while a loudspeaker can be pulled out from the case on a flexible tether member. The length of the flexible tether is sufficient to

permit the loudspeaker to be placed near the user's ear while the user holds their wrist so that the microphone, on the case of the apparatus, is adjacent to the user's mouth.

US-A-5 239 521 discloses a telephone where the strap has a top layer and a bottom layer. The top layer of the strap is releasable in the area where the case and strap meet and is connected to the bottom layer of the strap by a pivotable hinge which permits the top layer to rotate laterally of the strap. A loudspeaker is located on the free end of the released top layer, while a microphone is located on the strap. In use, the top layer is released and rotated to position the speaker in the palm of the user's hand. The hand is then raised to the side of the user's head to enable a private telephone conversation to be made.

A disadvantage of all of these proposals is that they are cumbersome, involving either mechanically vulnerable extensions or unsightly wires.

Disclosure of Invention

An object of the present invention is to provide a personal communications apparatus having an adequate separation between microphone and loudspeaker without requiring mechanically vulnerable extensions or unsightly wires.

According to the present invention there is provided a personal communications apparatus comprising a first part having a microphone and a second part having an loudspeaker, characterised in that communication between said first and second parts is by means of signals transmitted via the skin of the user.

The present invention is based upon the recognition, not present in the prior art, that the required physical separation between microphone and loudspeaker can be achieved by transmitting data and power via the skin of the user.

The use of body coupling for communication between a transmitter mounted on a finger and a receiver mounted on the wrist of the same hand is discussed in the paper "Body Coupled FingeRing: Wireless Wearable Keyboard" by M Fukumoto and Y Tonomura in the published papers of the

ACM Conference on Human Factors in Computing Systems (CHI 97), 22-27 March 1997, Atlanta, USA, pp.147-154. The application being considered in this paper is an input device for a computer that utilises a typing action without requiring a bulky keyboard.

The possibilities for wireless transmission of data and power around the body are discussed in the paper "Intrabody Buses for Data and Power" by E Post et al in the published papers of the First International Symposium on Wearable Computers, 13-14 October 1997, Cambridge, USA, pp.52-55. Such Personal Area Networks (PANs) have been demonstrated with data rates of 9600 bits per second (bps), with the possibility of data rates of 50,000 bps in the near future. Wireless transmission of 20 mW of power from a hand to a foot has also been demonstrated, extracted from a 200 mW signal at 1 MHz.

Brief Description of Drawings

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a block schematic diagram of a personal communications apparatus;

Figure 2 is a view of a personal communications apparatus made in accordance with the present invention;

Figure 3 is a view of a personal communications apparatus made in accordance with the present invention being used as a telephone; and

Figure 4 is a diagram illustrating a means of electrical connection between finger-mounted loudspeaker and the remainder of a personal communications apparatus.

In the drawings the same reference numerals have been used to indicate corresponding features.

Modes for Carrying Out the Invention

A block schematic diagram of a personal communications apparatus 100 is shown in Figure 1. This particular example is based on a GSM cellular telephone, but similar principles apply to other cellular telephony standards

and to other personal communications apparatus, for example two-way radio.

Consider first the receiver part of the circuitry operating on a voice telephone call. An antenna 102 receives signals from a remote base station, which signals pass through a diplexer filter 104, the purpose of which is to prevent strong transmitted signals from leaking into and overloading receiver circuitry. The signals then pass into an radio frequency transceiver block (RF) 108, which down-converts the RF signal to a lower intermediate frequency (IF).

The IF signals pass to an intermediate frequency block (IF) 110 which down-converts the IF signal to a baseband signal. This signal then passes to a baseband processing block (BB) 112. This block performs a variety of tasks, including speech decoding, channel decoding and deinterleaving. Received audio signals are converted back to analogue signals for reproduction on a loudspeaker 118 or other suitable output device.

Now consider the transmission side of the circuitry. Voice signals are received by a microphone 114, or other suitable input device, and passed to the baseband processing block 112, where they are converted to digital form. The baseband processing block 112 then encodes the speech and performs channel coding and interleaving to reduce the received bit error rate. The resultant signal for transmission is modulated and passed to the IF block 110. Here the baseband signals are transposed up to an IF frequency.

The IF signal is passed to the RF transceiver block 108 where it is mixed up to the RF transmission frequency and amplified to the required power by a power amplifier (PA) 106. It is then passed through the diplexer filter 104 and transmitted by the antenna 102.

In prior art personal communications apparatus signal paths 116 and 120, from the microphone 114 to the baseband processing block 112 and from the baseband processing block 112 to the loudspeaker 118 respectively, are provided by conducting wires. In an apparatus made in accordance with the present invention at least one of the signal paths 116, 120 is via a user's skin.

An embodiment of a personal communications apparatus 100 made

in accordance with the present invention is shown in Figure 2. A microphone 114 is mounted on the inside of a wrist 202 of a user by means of a strap 204. More particularly, the microphone 114 is mounted directly on the strap 204, which strap provides the signal path 116 between the microphone 114 and the baseband processing block 112 which is housed in a casing 302 (Figure 3) on the outside of the user's wrist 202. Also housed in this casing is the remainder of the circuitry of the personal communications apparatus 100 with the exception of a loudspeaker 118 (and its associated drive circuitry).

The loudspeaker 118 is mounted on a finger 206 of the user by means of a ring 208. The signal path 120 between the loudspeaker 118 and baseband processing block 112 is via the skin of the user, taking advantage of its electrical properties.

A view of the personal communications apparatus 100 in use is shown in Figure 3. The user's hand is held against the side of their head so that the ring 208 is adjacent to an ear 308, thereby enabling sounds from the loudspeaker 118 (Figure 2) to be heard with minimal external interference, and so that the strap 204 is adjacent to the mouth, thereby enabling the microphone 114 (Figure 2) to pick up spoken sounds. This required position is a fairly natural pose, so use of the personal communications apparatus 100 is comfortable and convenient.

A casing 302 is attached to the strap 204, and includes the majority of the circuitry for the personal communications apparatus 100. Also provided is a display 304 and a keyboard 306 for controlling the apparatus 100. An antenna (not shown) is provided in the strap 204 or in the casing 302. The ring 208 also carries a casing 310 containing circuitry (not illustrated) to receive signals from which an audio signal can be extracted and provided to the loudspeaker 118 for reproduction.

Other variations on the above arrangement will be apparent to those skilled in the art. Examples of such variations include, but are not limited to:

- The microphone 114 could be made integral with the casing 302 which would then be worn on the inside of the user's wrist 202.
- The casing 302 could be located elsewhere on the user's body,

communicating with both the loudspeaker 118 and microphone 114 by means of signals transmitted via the skin of the user.

- The loudspeaker 118 could be mounted elsewhere on the user's body. For example, the ring 208 could be replaced by an earpiece containing the loudspeaker.
- The keyboard 306 could be replaced by a voice recognition device (not shown).
- Timekeeping circuitry (not shown) could be included in the casing 302, enabling the apparatus 100 to function as a watch or alarm.

An example of one possible arrangement for maintaining an electrical connection between the loudspeaker 118 and baseband processing block 112 is shown in Figure 4. In order to create an electrical circuit through which suitable signals can be transmitted, a signal path 120 from the wrist casing 302 to the ring casing 310 and a return path 402 from the ring casing 310 to the wrist casing 302 are required. Power to drive the circuitry in the ring casing 310 is extracted from the received signal.

In the illustrated embodiment the signal path 120 is via the user's skin. A 100 kHz sine wave is injected into the skin at the user's wrist 202 via a capacitively-coupled electrode 404. The signal is received by an electrode 406 built into the ring 208. The return path 402 is directly coupled via air, the signal being transmitted from an electrode 408 on the ring casing 310 and received by an electrode 410 on the wrist casing 302.

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design, manufacture and use of personal communications apparatus and component parts thereof, and which may be used instead of or in addition to features already described herein.

In the present specification and claims the word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. Further, the word "comprising" does not exclude the presence of other elements or steps than those listed.

Industrial Applicability

The present invention is applicable to a wide range of personal communications apparatus, including apparatus for cellular telephony and two-way radio.

CLAIMS

1. A personal communications apparatus comprising a first part having a microphone and a second part having an loudspeaker, characterised in that communication between said first and second parts is by means of signals transmitted via the skin of the user.

2. An apparatus as claimed in claims 1, characterised in that the first part further comprises a case incorporating a transceiver and baseband processing circuitry.

3. An apparatus as claimed in claim 1 or 2, characterised in that the first part has means for attachment to a wrist comprising a strap, which strap includes means for attaching the microphone and means for connecting the microphone to the baseband processing circuitry.

4. An apparatus as claimed in claim 2 or 3, characterised in that the microphone is included in the case.

5. An apparatus as claimed in any one of claims 1 to 4, characterised in that the first part includes an electrode for coupling signals into the user's skin.

6. An apparatus as claimed in any one of claims 1 to 5, characterised in that the second part is adapted to be carried by a finger.

7. An apparatus as claimed in any one of claims 1 to 5, characterised in that the second part is adapted to be worn as an earpiece.

8. An apparatus as claimed in claim 6 or 7, characterised in that the second part includes an electrode for receiving signals from the user's skin.

9. An apparatus as claimed in claim 8, characterised in that the second part has means for deriving its power from the signals transmitted by the first part.

10. An apparatus as claimed in any one of claims 1 to 9, characterised by a speech recognition device in the first part for controlling the

apparatus.

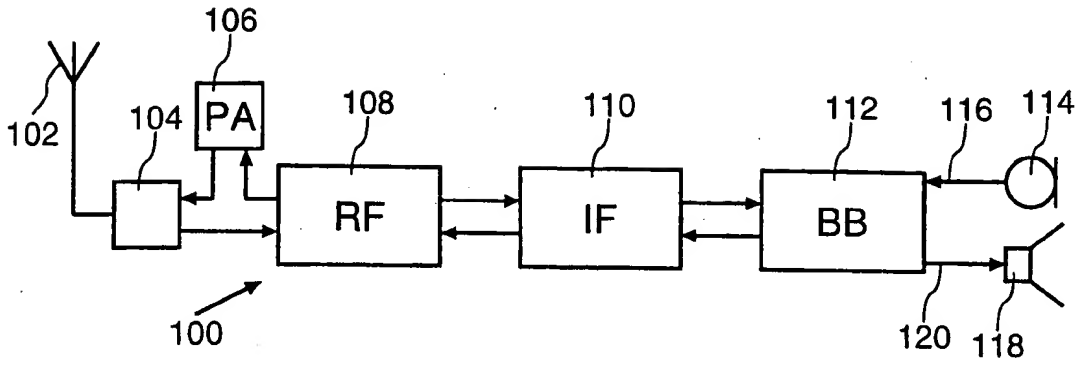
106
102
104
PA
108
110
112
116
114
RF
IF
BB
100
120
118

FIG. 1

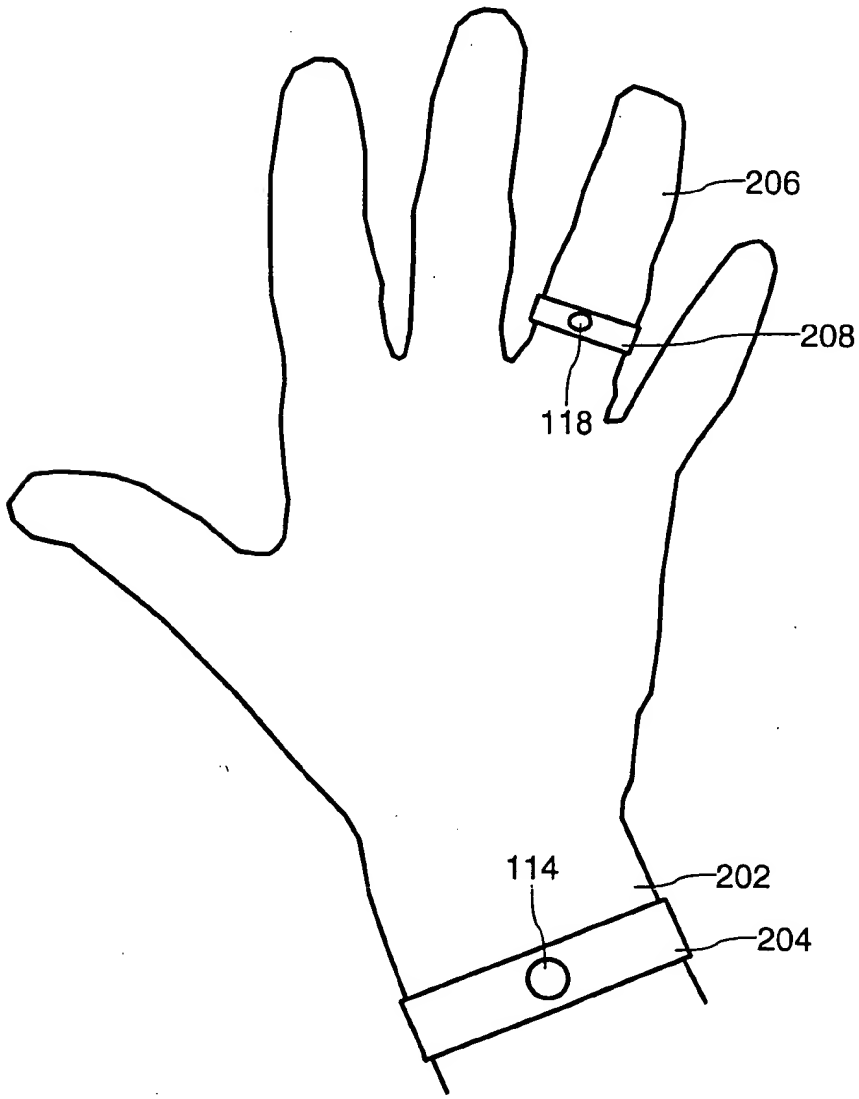
206
208
118
114
202
204

FIG. 2

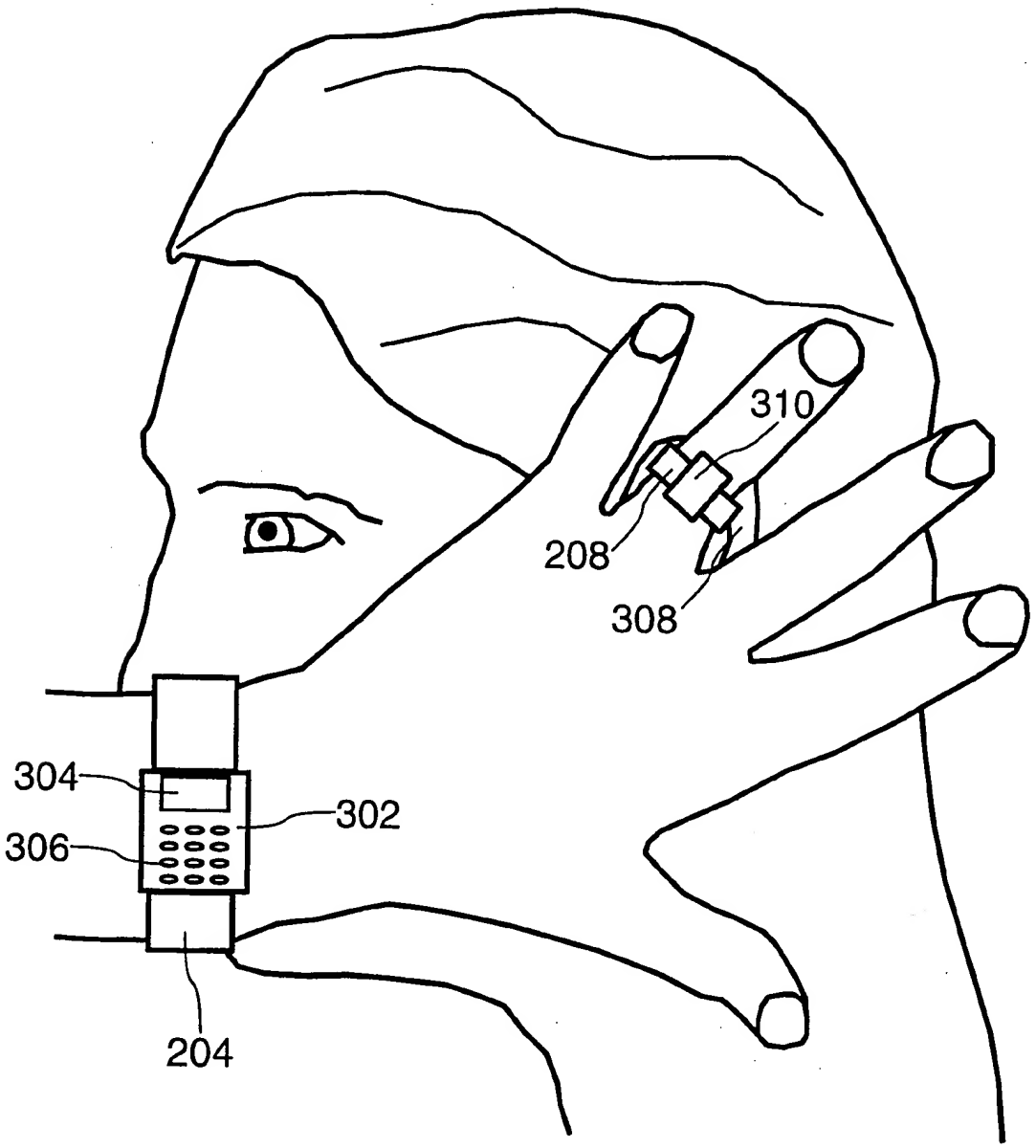

FIG. 3

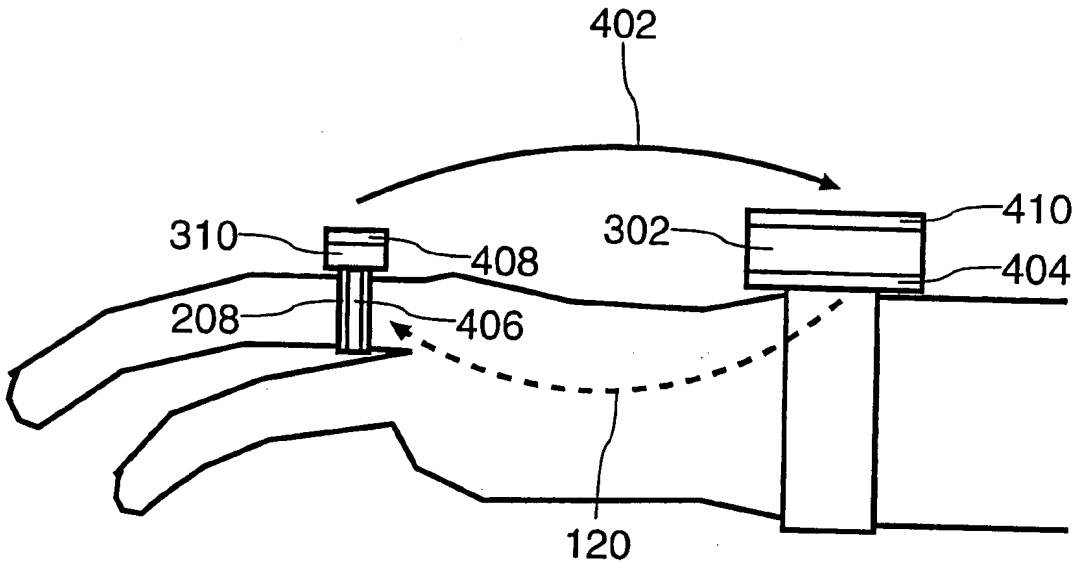

FIG. 4

INTERNATIONAL SEARCH REPORT

In. ational Application No
PCT/EP 99/06101

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B1/38 H04B5/02 G06F1/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FUKUMOTO M ET AL: "BODY COUPLED FINGERING: WIRELESS WEARABLE KEYBOARD" CONFERENCE ON HUMAN FACTORS IN COMPUTING SYSTEMS,US,NEW YORK, ACM,1997, pages 147-154, XP000697121 ISBN: 0-89791-802-9 cited in the application the whole document	1,2,4-6
Y	WO 98 27702 A (GHASSABIAN) 25 June 1998 (1998-06-25) page 7, line 1 -page 12, line 27; figures 1-5	1,2,4-6

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 January 2000	11/02/2000

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INTERNATIONAL SEARCH REPORT

In ational Application No
PCT/EP 99/06101

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 13, 30 November 1998 (1998-11-30) & JP 10 229357 A (N.T.T CORP.), 25 August 1998 (1998-08-25) the whole document	1,2,4-6
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A	EP 0 824 889 A (BURATTO ADVANCED TECHNOLOGY S) 25 February 1998 (1998-02-25) column 1, line 1 -column 2, line 37	1,5
A	GB 2 308 481 A (DAIMLER BENZ AG) 25 June 1997 (1997-06-25) abstract; figure 1	1,5
A	POST ET AL: "Intrabody buses for data and power" PROCEEDINGS OF THE 1997 1ST INTERNATIONAL SYMPOSIUM ON WEARABLE COMPUTERS;CAMBRIDGE, MA, USA OCT 13-14 1997,1997, pages 52-55, XP002129145 International Symposium on Wearable Computers, Digest of Papers 1997 IEEE Comp Soc, Los Alamitos, CA, USA cited in the application the whole document	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ational Application No
PCT/EP 99/06101

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